Los Alamos is developing powerful medical tool

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Scientists at Los Alamos National Laboratory are developing an ultra-low-field Magnetic Resonance Imaging (MRI) system that could be lightweight and low-power enough to be used on the battlefield and in field hospitals in the Third World.

"MRI technology is a powerful medical diagnostic tool, ideally suited for imaging soft-tissue injury, particularly to the brain," said Michelle Espy, the Battlefield MRI (bMRI) project leader.

But hospital-based MRI devices are big and expensive and require considerable infrastructure, such as large quantities of cryogens like liquid nitrogen and helium. The machines also typically use a large amount of energy.

"Standard MRI machines just can't go everywhere," said Espy. "Soldiers wounded in battle usually have to be flown to a large hospital, and people in emerging nations don't have access to MRIs at all. We've been in contact with doctors who routinely work in the Third World and report that MRIs would be extremely valuable in treating pediatric brain disorders and other serious diseases in children."

So the Los Alamos team started thinking about a way to make an MRI device that could be relatively easy to transport, set up and used in difficult settings.

Ultra-low magnetic fields

Espy and her team wanted to see if images of sufficient quality could be made with ultra-low magnetic fields, similar in strength to the Earth's magnetic field. To achieve images at such low fields they use exquisitely sensitive detectors called Superconducting Quantum Interference Devices (SQUIDs).

SQUIDs are among the most sensitive magnetic field detectors available, and interference with the signal is the primary stumbling block.

"SQUIDs are so sensitive they'll respond to a truck driving by outside or a radio signal 50 miles away," said Al Urbaitis, a bMRI engineer. The team's first-generation bMRI had to be built in a large metal housing in order to shield it from interference.

The Los Alamos team currently is working in an open environment without the large metal housing. Instead, they use a lightweight series of wire coils that surround the bMRI system to compensate for the Earth’s magnetic field. In the future, the field compensation system will also function similar to noise-cancelling headphones by eradicating invading magnetic field signals on the fly.

"We've been very happy with some of the initial imagery that's been produced from the lightweight, second-generation system," said Espy. "The new system indicates that, with additional development, these systems could be relatively easy and inexpensive to deploy."

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